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U. S. DEPARTMENT OF COMMERCE

Technical News Bulletin

of the

National Bureau of Standards

★ *Issued Monthly* ★

Washington FEBRUARY 1936 NUMBER 226

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PENETRATION OF MOISTURE INTO MASONRY WALLS

Rates of penetration of moisture through walls of brick masonry are being measured to determine what combinations of materials and types of construction are most resistant to leakage when exposed to rainfall. The walls are about 50 inches high and 40 inches long, and either 8 or 12 inches thick. Each of the specimens differs from the others with respect to thickness, kind of brick or mortar, or quality of workmanship. Included are walls of each of three kinds of brick, four mortar compositions and two qualities of workmanship. In the walls of class A workmanship, the joints are well filled with mortar, the method employed by the mason being similar to that described in specifications for high quality masonry. Class B workmanship is similar to that common in the construction of buildings where adequate inspection is lacking; the interior joints are not filled and the mason does not attempt to use more mortar than is required for an acceptable appearance.

Although the walls are to be tested also under conditions resembling exposure to strong wind and heavy rain, the data available now are largely the results of tests in which the water penetrates under the forces of capillarity and of gravity only. Water is applied by means of a spray at the top of a wall, causing the formation of a continuous film of water on the exposed face of the wall. Observations of the performances of a wall under test include the time for dampness first to penetrate through the wall, the rate of leakage, and the amount of water absorbed during a test.

The results of the tests indicate that, for walls of equal thickness, the quality of workmanship has a major influence on the rate of penetration of water. None of the walls of class A workmanship has leaked, whereas all of those with class B workmanship have allowed water to pass in measurable amounts. When dampness penetrated walls of class A workmanship, the moisture apparently was transmitted by capillarity. With the nearly nonabsorptive brick, moisture penetration was more rapid in the mortar than in the brick; with the more absorptive ones it was more rapid in the brick. The greatest leakage occurred with walls of bricks of low absorption and class B workmanship. The data

obtained thus far do not show how the composition of the mortar may affect the permeability of walls. They indicate, however, that the quality of the workmanship and the thickness of the walls have a greater influence on permeability than any of the other variable factors under study.

WORKABILITY OF CONCRETE

The relative ease with which a freshly mixed concrete may be placed in a uniform and compact state in the forms is of much importance from an economic and technologic viewpoint in the construction of concrete buildings and engineering structures. The property, which is related to ease of placement, is known to the engineer as the workability of the concrete. There has been no exact definition of the workability of concrete and there has been a current impression that the workability could be measured by a single test method and expressed by a single numerical value.

The Bureau is now engaged in a study of methods of measuring the workability of concrete. The present study has indicated that workability is dependent upon several independent factors, and tentative test methods have been developed for measuring its harshness, potential segregation, shear resistance, and adhesion. The harshness test distinguishes between the smoothness of a concrete with excess sand compared to the roughness of one that is deficient in sand; the potential segregation measures the mortar that separates from the concrete when it is jolted; the shear resistance is the resistance to flow which will, for example, resist the leveling of a heaped batch of concrete due to the action of gravity; and the adhesion measures the "stickiness" of the cement.

The test methods were applied to concretes made with several cements. The mixes covered a wide range of aggregate grading. The amount of cement and of water in the mix, the grading of the aggregate, fineness of the cement, etc., were found to influence the workability factors. The influence of these variables was different for the different tests; for example, the amount of cement present in a given quantity of concrete markedly affected the adhesion but did not appreciably affect the segregation; however, the ratio of cement to sand in the concrete did materially affect the segregation.

The results of the investigation will appear shortly in the Proceedings of the American Concrete Institute.

CHEMICAL COMPOSITION OF PORTLAND CEMENT

Recent work at this Bureau and elsewhere has emphasized the heterogeneous nature of portland cement by showing that its chemical constituents are distributed unequally among the differently sized particles making up the whole cement. Recognition of the existence of these inequalities in the size distribution of the chemical constituents is important since the inequalities are sufficiently large in many cases to render futile any attempts at quantitative explanation of the behavior of the whole cement merely on the basis of its chemical analysis. A further study of the problem on a larger number of cements has been made at the Bureau during the past year and the data found to support and extend previous conclusions.

In all, 13 cements, representing products of 6 different manufacturers, have been separated into size fractions and analyzed. The size separations were made by air elutriation as described in J. Research NBS 14, 419 (1935) RP777.

The results of the chemical analyses of the fractions showed that, in general, the tricalcium silicate in a cement tends to be more concentrated in the finer sizes, while the greatest percentages of dicalcium silicate are found in the largest sizes of particles. The tetracalcium alumino ferrite and the tricalcium aluminate seemed to be about equally distributed between the fine and coarse particles. The 0–7 micron fraction differed from the others in that it had the highest ignition loss and also contained the greatest portion of the sulphuric anhydride.

Five of the 13 cements were selected for more extensive study in the hope of arriving at an explanation of certain known discrepancies in the relation between their chemical composition and some of the physical properties of these particular cements. These five cements were of very similar chemical compositions and yet they were known to have rather widely differing strength and heat of hydration characteristics. It was believed that these discrepancies might have been brought about by the unequal size distributions of the chemical constituents, and heat of hydration measurements were accordingly made on the indi-

vidual fractions in order to find out if any better correlations could be obtained for definite sizes of particles of known composition.

Several equations were derived by the method of least squares giving the heats of hydration of one size fraction for one age as linear functions of the four major compounds, but none of these equations was found to yield good correlations, and the constants derived did not appear to be such as to have any physical significance. This suggested that if the properties of these cements were to be fully explained, further studies of the chemical constitutions would have to be made and that possibly some of the observed peculiarities were the result of errors in the compound compositions (calculated by the Bogue method) brought about by incomplete crystallization of the cement clinkers. Such effects have recently been pointed out by Lea and Parker in England.

Petrographic examinations on etched thin sections of the cement clinkers supported the theory that the calculated compositions were in error. The compound compositions, as estimated petrographically, differed considerably from the calculated values, and some of the clinkers were found to contain appreciable quantities of glass. Furthermore, when the heats of solution of the whole cements were calculated from their compound compositions as estimates petrographically, better agreement with the observed values resulted than when the heats of solution were calculated from the compound compositions by the method of Bogue. It thus appears that poor correlations obtained between the physical and chemical properties of cements and their calculated compound compositions may be due to inaccuracies in the method of computing the compound compositions.

PROTECTIVE VALUE OF ZINC AND CADMIUM COATINGS ON STEEL

For many years hot galvanized iron—that is, iron coated by dipping it into molten zinc—has been used extensively where protection against corrosion of the iron is more important that appearance. Zinc plating, also known as electrogalvanizing, is used especially on those parts where the dimensions must be controlled. To some extent cadmium plating has replaced zinc plating, in spite of the higher cost of cadmium, because of its better initial appearance.

An investigation described in the February number of the Journal of Research (RP867) was undertaken to determine the relative protective value of these coatings. Numerous specimens were prepared through cooperation with the American Electroplaters' Society, and, with the assistance of the American Society for Testing Materials, these were exposed in six locations. The results of 3½ years' continuous exposure may be summarized as follows:

Thin coatings of zinc or cadmium furnish better protection against corrosion of iron or steel in rural or marine climates than do equally thin coatings of nickel or chromium (reported in 1934), although the zinc and cadmium lose their luster more rapidly. In industrial locations, where sulphur compounds are present in the atmosphere, both zinc and cadmium fail rather rapidly. Under these conditions cadmium fails in about two-thirds of the time required for failure of zinc coatings of the same thickness. Deposits of an alloy containing about 90 percent of zinc and 10 percent of cadmium are somewhat superior to either zinc or cadmium. The conditions selected for preparing the steel and for the plating have little effect on the protective value, provided the deposits are adherent and have the necessary thickness. Electroplated zinc coatings have about the same value as hot-dipped zinc coatings *with the same thickness.*

Accelerated tests are not entirely satisfactory for determining the relative merits of such coatings. For example, cadmium coatings last longer in the salt spray but fail more rapidly in an industrial climate. The best criterion for the quality of a zinc or cadmium coating is its minimum thickness. This can be determined by various simple laboratory tests, such as the dropping test, microscopic examination, and the chord test.

MEASURING THE THICKNESS OF METAL COATINGS

Recently adopted specifications for electroplated coatings include requirements for the minimum thickness on any significant part of the plated surface, rather than the average thickness that has heretofore been specified. The application of such specifications depends upon the determination of thickness at different parts of the surface. This is usually done by microscopical measurements of metallographic cross sections, a procedure that is laborious

and time-consuming and that destroys the test specimen.

Recently F. C. Mesle described an ingenious method of measuring the thickness of silver on teaspoons, especially on the outside of the bowl where a greater thickness or "overlay" is often applied. The same principle can be used to measure coatings on flat surfaces. If a coating on a curved surface is just cut through with a flat file, or that on a flat surface is cut through with a grinding wheel of known radius, the thickness of the coating can be computed from the equation

$$T=\frac{C^2}{8R},$$

where T is the thickness, C is the chord, that is, the width of the cut, and R is the radius of the curved surface or of the grinding wheel.

To apply the method to a practically plane surface, the latter is tilted slightly, so that a tapering cut is produced when the surface is passed under the grinding wheel in a direction parallel to its axis. The chord is then measured just at the point where the base metal is exposed. This procedure is especially valuable for measuring the individual layers in multiple coatings, such as of nickel, copper, and nickel on steel.

For testing deposits on soft base-metals such as copper, brass and zinc-base die-castings, a wheel with a relatively coarse grain, such as a 90-grain, is preferable. On steel, a 120-grain wheel gives sharper cuts. The width of the cut is measured with a lens and scale.

Tests made on specimens plated with known thicknesses showed that the method is accurate to about 10 percent on coatings at least 0.0002 inch (0.005 mm) thick. It is a much more rapid method than the metallographic examination, and under favorable conditions the results are almost as accurate. In general the tested specimen can be salvaged by stripping, polishing, and replating. This is an advantage in testing large pieces such as bumper bars. It is hoped that after thorough trial this method will prove useful in testing plated products for compliance with specifications.

A more complete account of this work will be found in RP866 in the February number of the Journal of Research.

PURE IRON

The extraordinarily important role of iron and its alloys in modern industrial life necessitates the acquiring and compiling of adequate and accurate data. One of the current metallurgical researches at the Bureau is the determination of the fundamental properties of elemental iron (Technical News Bulletin 224; December 1935), and in the February number of the Journal of Research (RP860) the Bureau summarizes available information regarding the preparation and properties of the purest forms of iron produced theretofore. Existing information will be supplemented by the determination of the properties of iron of high purity and of accurately known composition, now being prepared in the Bureau's laboratories.

SILVER COATINGS TO PROTECT CARBON STEELS DURING ANNEALING

In the course of some recent work at the Bureau, which required the full annealing of both medium carbon and high carbon steels with the utmost protection against oxidation or decarburization of the surfaces, it developed that silver coatings are a satisfactory means to accomplish this end, although probably not so well known or so widely used as are other methods of protection.

Polished mild steel surfaces bearing finely engraved designs may be coated with a thin electrolytic deposit of silver, annealed, and the silver stripped electrolytically, leaving the steel surface in practically its initial condition. Electroplated silver has also been used to protect rather thin section, high-carbon steel pieces during annealing with assurance that the insolubility of silver in iron will prevent modification of the chemical composition of the steel by penetration of the silver.

WIRE FOR RESISTANCE STANDARDS

In the national standardizing laboratories the unit of electrical resistance is maintained by means of groups of wire-wound standards. These laboratories are interested in improving the stability of these standards, either by better methods of construction or by the development of more stable resistance alloys.

Besides stability, resistance alloys should have low temperature coefficients of resistance and small thermoelectric powers against copper. An alloy of copper, manganese, and nickel, known as manganin, is generally used.

An investigation at the Bureau, reported in the February number of the Journal of Research (RP863) shows that an alloy of copper, manganese, and aluminum is in some respects superior to manganin. The best propor-

tions of these three metals were found to be approximately: Copper, 85 percent; manganese, 9.5 percent; and aluminum, 5.5 percent. When properly baked, coils of wire made of this material have smaller temperature coefficients of resistance, and smaller thermoelectric powers against copper, than manganin. This alloy appears to be as stable in resistance as is manganin, but it undergoes a large change in resistance with baking, and the baking time and temperature must be carefully controlled. The method of preparation and data obtained for these alloys are given in the report.

STANDARD SOURCE OF ULTRAVIOLET RADIATION

For some years an investigation has been in progress at the Bureau on methods of evaluating the ultraviolet of short wave lengths in sunlight, recognized as having a therapeutic value, at least in healing rickets.

One difficulty encountered in this investigation is the calibration of the radiometers (thermoelectric and photoelectric) used for evaluating the ultraviolet radiation in absolute units. Recently an experimental procedure has been developed which gives close agreement in the values of ultraviolet solar radiation as deduced by the two methods (thermoelectric and photoelectric) of measurement. This is accomplished by the development of a standard of ultraviolet radiation for calibrating the photoelectric ultraviolet dosage intensity meter in absolute value.

In RP858 in the February number of the Journal of Research the advantages and disadvantages of using sources emitting either a continuous or a discontinuous spectrum are considered in connection with the use of such lamps as a standard source of ultraviolet radiation.

It is shown that because of the high intensity and favorable distribution of the ultraviolet emission lines at 2967 to 3132 A. the quartz mercury-arc lamp is well adapted for standardizing photoelectric ultraviolet dosage intensity meters in absolute units.

A description is given of the installation of a commercial 110-volt vertical quartz mercury Uviarc lamp, and of methods of calibrating its ultraviolet output in absolute units.

By calibrating photoelectric ultraviolet intensity meters against a laboratory standard a great reduction is effected in equipment required for field measurements of ultraviolet solar radiation.

GUARDED-FIELD X-RAY IONIZATION CHAMBER

A note in the NBS guarded-field ionization chamber is contained in the February number of the Journal of Research (RP865). The number of guard wires has been reduced from 12 to 8, and the other attendant alterations necessitated thereby are given in the paper. It is shown that strictly uniform potential distribution between guard wires is not essential and that ionization between guard wires, therefore, produces no spurious effects within the chamber. Coin-gold diaphragms have replaced those used prior to 1931. Coplanarity of electrodes is assured by making them as a single unit.

STORAGE OF LINEN WITH CELLULOSE NITRATE KNITTING NEEDLES RESULTS IN DAMAGE TO CLOTH

Textile laboratories are often called upon to determine the cause of deterioration in or damage to textiles from an examination of the damaged material. This may be a rather difficult problem because the undamaged material is seldom available for comparison and valuable evidence is often destroyed by laundering or use of the textile subsequent to the occurrence of the damage.

An interesting example of deteriorated linen was brought to the Textile Section of the Bureau recently. This linen had been kept for a number of years in the drawer of a sewing cabinet located in a living room. One piece had been hemmed and was ready for use as a napkin. The napkin, apparently in good condition, was used and sent to the laundry. When it came back there were large, symmetrically spaced holes along the folds. An unobservant person might have held the laundry responsible for this damage, but the location and nature of the holes showed clearly that the damage was done while the napkin was folded. No chemicals were found in the fabric which would account for the damage.

Other pieces of the linen which had not been laundered, were found to be greatly deteriorated. In some places they were brittle and would powder when rubbed between the fingers. Several knitting needles stored in the same drawer were likewise found to be weak and brittle.

The last-mentioned observation was the clue to the solution of the problem. The knitting needles were found to be made of a cellulose-nitrate plastic. Cellulose nitrate is not very stable. It liberates oxides of nitrogen when it deteriorates. The linen was

strongly acid in reaction and gave a strong test for nitrate ion.

The evidence seems conclusive that nitric acid formed from the gases given off by the decomposition of the cellulose-nitrate knitting needles attacked the linen over a period of time and was the cause of the damage. Nitric acid was not found in the laundered napkin because it had been removed in the laundering.

If the owner of the deteriorated linen had not been observant and had not furnished all of the material bearing on the problem, the cause of the deterioration probably would have remained a mystery.

EFFECT OF YARN TWIST ON THE PROPERTIES OF CLOTH

In order to design a cotton cloth having the best possible combination of properties for a given use, it is desirable, if not essential, to know how each of the properties in question is affected by the changes that can be made in the construction of the cloth. If, for instance, the twist in the warp and filling yarns is varied, the breaking strength, elongation at rupture, and fabric assistance are affected. A report (RP861) in the Journal of Research for February is concerned with this effect as noted in plain-weave and 2/2 basket-weave cloths made from 10s (8.4 typp) cotton yarns.

The number of warp and filling yarns per inch of cloth was kept constant at 34 in both weaves. The cloths were woven in various combinations of warp and filling twist multipliers, ranging from 2.5 to 9. The breaking strength and elongation at rupture of the cloths were found to vary approximately with the breaking strength and elongation at rupture of the yarns from which the cloths were woven. The fabric assistance varied inversely with the breaking strength of the yarn. The direction of twist in the yarn had no significant effect on the results. The breaking strength, elongation at rupture, and fabric assistance were greater in the plain weave than in the 2/2 basket weave. The cloths were tested by the grab and strip methods, and the effect of the method of test is shown in the report.

EFFECT OF CONSTRUCTION ON THE PROPERTIES OF CLOTH

By using the results reported in RP862 in the February number of the Journal of Research it is possible to design cotton cloths to meet definite requirements. The results have been useful in the development of satisfactory cotton cloths for parachutes. The work is a part of the general program undertaken at the Bureau to provide systematic data on the effect of changes in construction on the properties of cloth.

Series of plain-weave and 3/3 basket-weave cloths were woven from 80s (67.2 type) cotton yarns, varying the number of warp and filling yarns per inch from 80 to 120, and the twist multiplier of the filling yarns from 2.48 to 5.64. The cloths were tested for weight, thickness, air permeability, elongation at rupture, breaking strength, fabric assistance, and tear resistance. The effect which the variations in construction had upon these properties is reported and discussed.

Experimental data are given concerning the effect produced by abrasion of the yarns (during weaving) on the breaking strength and fabric assistance of cloths woven from 2/140 (2/117.6 typp) mercerized cotton yarns. The number of warp yarns per inch was kept constant at 114 and the number of filling yarns per inch varied from 30 to 120.

TREATMENT OF OFFSET PAPER FOR OPTIMUM REGISTER

It has been found in the Bureau's Paper Section that serious waste in the lithographic industry, incurred by misregister of prints in multicolor offset printing, can be avoided by a new method of treating the paper. It appears that this new method of treatment will result in conservation of material by reduction of spoilage, decreased loss of production, and improved quality of products. The Bureau's investigation has shown that paper does not often stretch out of shape during printing as formerly believed but expands because of the water added by the wet press. This results in poor register of successive color prints, the offset printer's most serious difficulty.

In multicolor printing by the offset process, several colors, often as many as 15, are printed separately, and the problem of making the different colors fit one on top of the other is a serious one. It is particularly difficult because the paper changes size with gain or loss of moisture, which happens as often as the relative humidity of the surrounding air changes. Even with close control of air conditions in the pressroom and using the most carefully made paper, the paper must be given special conditioning treatment to prevent the expansion that has been wrongfully attributed to stretch.

Paper prepared for printing by the conventional practice of exposing it to the pressroom atmosphere until its moisture content was in balance with the room air, usually expanded during the first few printings so that succeeding colors printed inside the first. The expansion, which was found to be due to moisture added by the press, was avoided by raising the moisture content of the paper above equilibrium with the pressroom air at the start. By the proper control in paper conditioning, the Bureau was able to maintain constant dimensions and obtain practically perfect register of color prints in six to nine color printings in the air-conditioned printing plant of the U. S. Coast and Geodetic Survey. The information obtained in the investigation has been applied in the commercial printing of maps of 9 to 17 colors with excellent results. The new practice has been an important factor in reducing register difficulties.

Those interested in a more complete report of this investigation should consult RP859 in the February number of the Journal of Research.

SOME PHYSICAL PROPERTIES OF ISOPRENE

Pure isoprene has been prepared for the purpose of measuring its entropy and free energy, and thereby determining its thermodynamic relation to rubber. The isoprene was made by the cracking of dipentene and was purified by three successive distillations through an efficient 40-bulb fractionating column. A fraction boiling within a range of about 0.01° C was obtained. The purity of this fraction was of the fifth (or highest) order on the scale of Swietoslawski as determined by the difference, 0.002° C, between the temperatures of boiling and condensation. Some of the physical constants of this fraction are as follows:

Boiling point (°C)	34.076
Change of boiling point with pressure (°C per mm)	0.0383
Freezing point (°C)	about −146
Density at 20° C (g per ml)	0.6805
Refractive index, n_D^{20}	1.42160
Change of refractive index with temperature (per °C)	0.00066_3
Molecular refraction (from Lorenz-Lorentz formula)	25.39

When the isoprene was stored at a temperature of about 8° C over a period of days it was observed to undergo a progressive change as indicated by increases in density, refractive index, boiling point, difference between boiling and condensation temperatures, and rate of change of boiling point with pressure. This change is doubtless due to polymerization and will necessitate the use of freshly distilled samples in the determinations of heat capacity and heat of combustion from which the thermodynamic constants are to be derived.

NEW AND REVISED PUBLICATIONS ISSUED DURING JANUARY 1936

Journal of Research [1]

Journal of Research of the National Bureau of Standards, vol. 16, no. 1, January 1936 (RP857). Price 25 cents. Obtainable by subscription.

Research Papers [1]

[Reprints from the October and November 1935 Journal of Research]

RP837. Hardening characteristics and other properties of commercial one-percent-carbon tool steels. T. G. Digges and Louis Jordan. Price 5 cents.

RP840. Design and construction of an experimental diffusion battery. Max J. Proffitt. Price 5 cents.

RP841. The difference in vapor pressures of ortho- and paradeuterium. F. G. Brickwedde, R. B. Scott, and H. S. Taylor. Price 5 cents.

RP843. Standardization of permanganate solutions with sodium oxalate. Robert M. Fowler and Harry A. Bright. Price 5 cents.

RP844. Heat capacity, entropy, and free energy of rubber hydrocarbon. Norman Bekkedahl and Harry Matheson. Price 5 cents.

RP848. Thermal decomposition of talc. R. H. Ewell, E. N. Bunting, and R. F. Geller. Price 5 cents.

SIMPLIFIED PRACTICE RECOMMENDATIONS [1]

R161–35. Packaging of automotive (bus) engine parts. Price 5 cents.

R162–35. Packaging of air-brake (electric railway) parts. Price 5 cents.

TECHNICAL NEWS BULLETIN [1]

Technical News Bulletin no. 225, January 1936. Price 5 cents. Obtainable by subscription.

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[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscriptions to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

OUTSIDE PUBLICATIONS [2]

Pipe line fabrics. Gordon N. Scott and Scott Ewing. Am. Dyestuff Reporter (90 William St., New York, N. Y.), **24,** 699 (Dec. 16, 1935).

La theorie de l'accumulateur electrique au plomb. G. W. Vinal and D. N. Craig. Revue Gèneral d'Electricité (Paris, France), **38,** 812 (Dec. 14, 1935).

Methods of testing wood treated with fire retardants. C. R. Brown. Proc. Am. Soc. Test. Materials (260 S. Broad St., Philadelphia, Pa.), **35,** 674 (1935).

Accelerated aging test for weighted silk. W. D. Appel and D. A. Jessup. Am. Dyestuff Reporter (90 William St., New York, N. Y.), **24,** 706 (Dec. 16, 1935).

It's pulled at the seam. Ruby K. Worner. Textile World (330 West 42d St., New York, N. Y.), **85,** 2544 (December 1935).

Comparative wear of chrome, vegetable and retanned sole leather. R. C. Bowker and W. E. Emley. J. Am. Leather Chem. Assn. Ridgway, Pa.), **30,** 572 (November 1935).

Deterioration of vegetable-tanned leather containing sulphuric acid and glucose. Everett L. Wallace and Joseph Kanagy. J. Am. Leather Chem. Assn., **30,** 614 (December 1935).

Effect of acid on leather. A summary. Warren E. Emley. J. Am. Leather Chem. Assn., **30,** 620 (December 1935).

Transparent plastics for aircraft windows. Gordon M. Kline. Ind. Eng. Chem., News Edition (Mills Bldg., Washington, D. C.), **13,** 479 (Dec. 20, 1935).

Continuous-flow corrosion tests of steel pipe. H. S. Rawdon and L. J. Waldron. Proc. Am. Soc. Test. Materials (260 S. Broad St., Philadelphia, Pa.), **35,** part II, 233 (1935).

Hardening characteristics of 1 percent carbon tool steels. T. G. Digges and Louis Jordan. Trans. Am. Soc. Metals (7016 Euclid Ave., Cleveland, Ohio), **23,** 839 (1935).

The nature of the glass phase in heated clay materials. I. Common clays. G. R. Shelton. J. Am. Ceram. Soc. (2525 North High St., Columbus, Ohio), **18,** 289 (October 1935).

Compounds in portland cement revealed by high-temperature research upon cement components. R. H. Bogue. Paper No. 31, Portland Cement Assn. Fellowship (National Bureau of Standards, Washington, D. C.) (November 1935).

[2] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1935